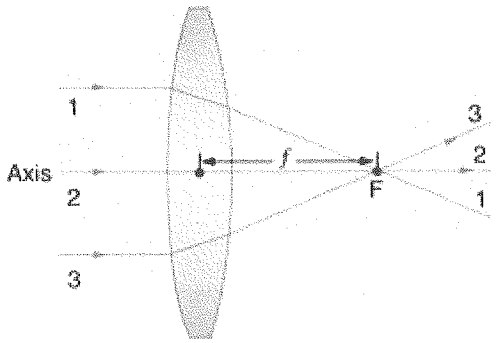
Name: Key

Notes - 25.6 Image Formation by Lenses - Part 2

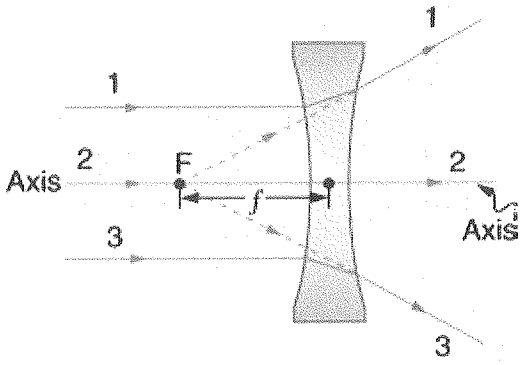
1. Ray tracing is the technique of determining or following (tracing) the paths that light rays take. While ray tracing for complicated lenses, such as those found in sophisticated cameras, may require computer techniques, there is a set of simple rules for tracing rays through thin lenses.

2. Ray Tracing Rules

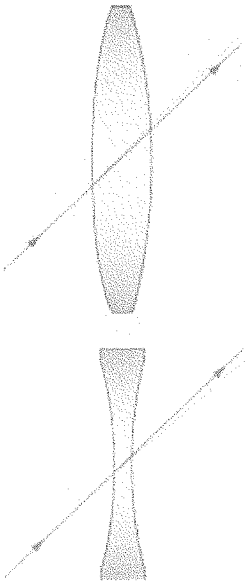
   1. A ray entering a converging lens parallel to its axis passes through the focal point F of the lens on the other side.



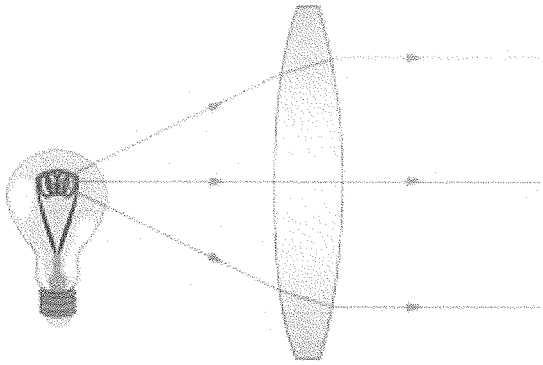
   2. A ray entering a diverging lens parallel to its axis seems to come from the focal point F.



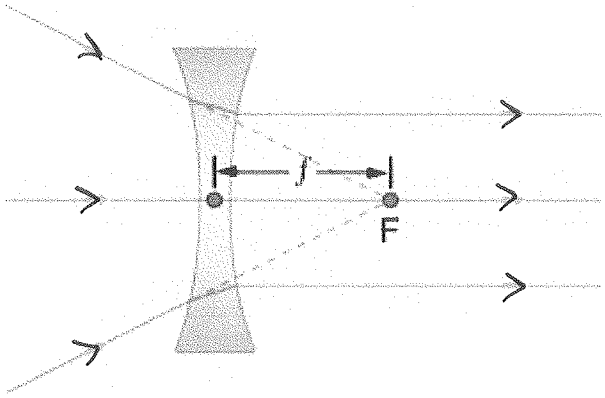
   3. A ray passing through the center of either a converging or a diverging lens does not change direction.



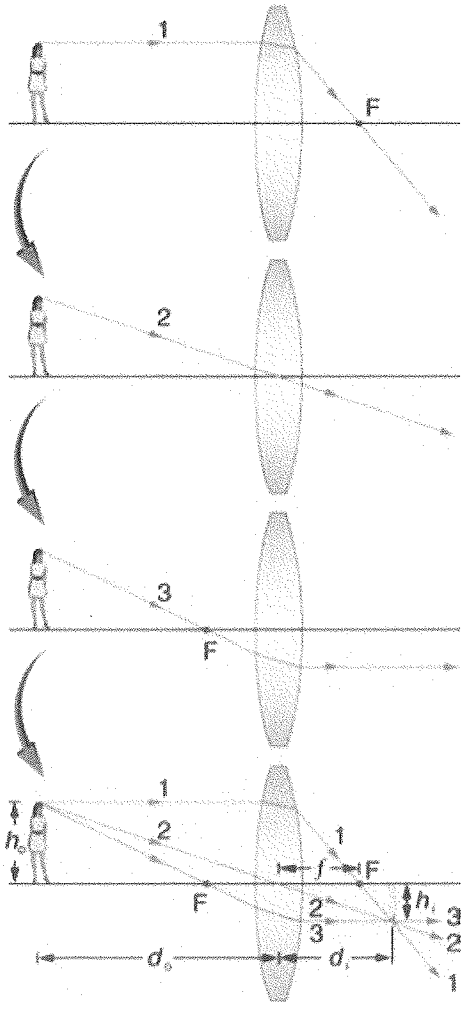
4. A ray entering a converging lens through its focal point exits parallel to its axis.



5. A ray that enters a diverging lens by heading toward the focal point on the opposite side exits parallel to the axis.



3. Ray tracing is used to locate the image formed by a lens.



4. The Lens Equation and Magnification

$$\frac{1}{d_o} + \frac{1}{d_i} = \frac{1}{f}$$

$$\frac{h_i}{h_o} = -\frac{d_i}{d_o} = m$$

where

d_o = object distance from lens
d_i = image distance from lens
f = focal length
h_i = image height
h_o = object height
m = magnification

5. Three Types of Images Formed by Thin Lenses

Table 25.3 Three Types of Images Formed By Thin Lenses

Type	Formed when	Image type	d_i	m
Case 1	f positive, $d_o > f$	real	positive	negative
Case 2	f positive, $d_o < f$	virtual	negative	positive $m > 1$
Case 3	f negative	virtual	negative	positive $m < 1$